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PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in or relating to Needle-roller Bearings

We, WELHELM SCHAEFFLER and GEORG SCHAEFFLER, both German nationals, trading as Industriewerk Schaeffler oHG, Herzogenaurach, near Nürnberg, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a needle roller bearing of the kind having an annularly grooved inner or outer race, and an axial retaining ring having a closed plastically deformable dished form which can be flattened by pressure to spread the ring radially into the race groove.

It has already been proposed in the case of needle bearings having needle cages, that such axial retaining rings be constructed not as divided elastic rings e.g. the known Seger rings, but as closed rings which consist of plastically deformable material and which are pressed with a shape-locking effect into a groove on the outer or inner race of the needle bearing. Before insertion, these rings are given a frusto-conical construction i.e. the upper and lower annular surfaces of the rings form acute angles to the axis of the ring. The diameter of the ring rim which is to be inserted into the groove i.e. in the case of rings for insertion into grooves formed in outer races, the outer diameter, and in the case of rings to be fitted into grooves formed in inner races, the inner diameter of the ring, is somewhat smaller than the diameter of the outer race, or greater than the diameter of the race as the case may be. For insertion, these rings are brought into a position corresponding to the annular receiving groove, gripped by deforming devices and deformed to constitute a ring having bearing surfaces perpendicular to the axis of the ring, so that after their outer diameter has been enlarged or their inner diameter reduced the rings penetrate into the groove and are fixed therein.

It is also possible for only one bearing surface of the ring to be of conical construction at its outer or inner portion, so that, when the ring is deformed, the material of the annular conical projection penetrates into the groove and retains the ring therein.

When this type of ring is used difficulties are encountered more especially due to the close tolerances to which the ring must be made. The variations in ring diameter are allowed for, in most cases, by cutting the grooves in the inner or outer race deeper than would be necessary for the maximum deformation of the ring after the ring has been pressed flat. This leads to the following difficulties; if the groove depths are made too large, the rings will not be secured in the radial direction and are therefore capable of turning within the groove. If, on the other hand, the groove depths are too small, the ring bears upon the bottom of the groove producing considerable radial forces, these forces becoming greater the shallower the depth of groove. In this case considerable pressure forces are produced at the bottom of the groove, which, reinforced by the wedging effect of the ring, invariably leads to considerable deformation of the parts in which the groove is formed. Both loose rings which are free to turn within the grooves and high pressures against the races are unsuitable for needle bearing races, more especially since the wall thicknesses of these needle bearing races are less than for races in almost any other general case of application. Therefore, despite the advantages of the closed rings of this type which are constructed without any joint, these rings have not been able to be used up to the present time for retaining in the axial direction needles and cages of needle bearings.

An object of the invention is to provide a solution which makes it possible to bring a ring of this type into contact with the bottom of the groove after the ring has been pressed into position and thus to secure the ring against rotation, without exerting considerable pressure on the bottom of the groove and thus on the race of the needle bearing.

According to the invention there is provided an axial retaining ring of the kind specified, wherein the dimensions of the ring are such that an inner or outer rim thereof will press against the bottom of the groove, when the ring is fully spread into the groove, with sufficient radial pressure to prevent rotation of the ring in the groove, said rim being shaped so that the aforesaid pressure is transmitted by a surface area of the rim which is only a small fraction of the overall rim surface area and is insufficient to induce deformation of the grooved part.

In order that the invention may be clearly understood and readily carried into effect, several embodiments thereof will now be described in detail with reference to the accompanying drawings, to differing scales, in which:

Figure 1 is a section showing the outer race of a needle bearing with an axial retaining ring according to the invention in position.

Figure 2 shows, on a somewhat enlarged scale, a peripherally recessed ring in two position prior to insertion in a groove and the second being a suitably deformed position in a groove in the outer race of a needle bearing.

Figure 3 shows in plan and elevation a constructional example of an axial retaining ring having a toothed rim.

Figure 4 is a section showing the inner race of a needle bearing with an axial retaining ring spread or pressed therein, and

Figure 5 shows to a larger scale the construction of a ring as in Figure 4 before insertion within the groove.

Referring now to the drawings, in Figure 1 the outer race of a needle bearing is shown at 1. On the inner bearing surface 2 of the outer race travel bearing needles 3 guided in a cage 4. This cage 4, as well as the bearing needles 3, is limited in its axial movement in one direction by an axial retaining ring 5 which is itself secured against axial displacement in a groove 6, formed in the outer race 1 of the bearing. This groove 6 has an oblique outer surface 7 which is sharply inclined to the axis of the bearing.

In Figure 2 an outer race 1a of a needle bearing constructed similarly to the race shown in Figure 1, is shown having a groove 6a sharply pointed at 6' and an oblique groove surface 7a. An axial retaining ring 8, having side faces at an oblique angle to the ring axis is provided at its outer rim surface with a preferably central peripheral recess 9 forming two circular edges 10 and 11 of small cross-section. The outer diameter of this ring is, in the undeformed state, of such overall dimensions as to be capable of being inserted into the bore 12 of the outer race 1 without the need for substantial expenditure of force. When the ring 8, which, after initial insertion, is still oblique relative to the ring axis, is deformed, to become flat as at 14, the outer rim diameter thereof is increased, whilst the internal rim diameter at the ring bore 15 is maintained constant by means of a mandrel, and the edges 10 and 11 come into contact with the inclined surface 7a.

A further construction of the outer rim of a ring of this kind is illustrated in Figure 3. A ring 16, which is shown in the non-fitted condition with side faces 17 inclined relatively to the axis of said ring, has peripheral teeth 18 formed thereon, which teeth have only a small cross-section in proportion to the total cross-section of the ring. The comparatively very small teeth 18 are easily deformed when they contact a groove surface such as is designated with the reference numeral 7 and 7a respectively in Figures 1 and 2, without substantial radial forces being exerted on the ring 16 itself. Thus the projections exert only slight pressure on the bottom of the groove, the pressure however being sufficient to fix the ring in position and hence to prevent undesirable turning of the retaining ring. The amount of contact required for this purpose is kept so small that the parts which carry the mounting groove e.g. the races of needle bearings, do not become deformed.

The axial retaining rings can also be used for the inner races of needle bearings in similar manner to that described with reference to Figures 1 to 3.

Figure 4 shows such an inner race 19 of a needle bearing, with race-way 20, a groove 21 in the said race-way carrying a retaining ring which comes into contact radially with the bottom of the groove only around edge 22.

A similar ring 23 is shown in Figure 5, on a slightly larger scale, before it is pressed into the groove.

Before being deformed, the ring is brought into the plane of the groove 24, and is then so deformed by appropriate means that its side retaining faces are disposed at approximately right angles to the axis of the needle bearing race. In so doing, rim edge 25 first comes into contact with the bottom of the groove and provides the requisite contact for preventing rotation of the ring 23, without exerting any great pressure on the bottom of the groove 24 and

thus on the race itself.

WHAT WE CLAIM IS:—

1. In, or for use in a needle roller bearing of the kind specified, the combination of an axial retaining ring and grooved race having relative dimensions such that an inner or outer rim of the ring will press against the bottom of the groove, with sufficient radial pressure to prevent rotation of the ring in the groove, when the ring is fully spread into the groove, said rim being shaped so that the aforesaid pressure is transmitted by a surface area of the rim which is only a small fraction of the overall rim surface area and is insufficient to induce deformation of the grooved part.

2. A combination as claimed in Claim 1, wherein the said rim is so constructed that when the ring is spread or pressed into position only the leading edge of said rim, in the direction in which the ring was inserted, bears against the bottom of the groove.

3. A combination as claimed in Claim 1, wherein the rim has a preferably central peripheral recess, the arrangement being such that when the ring is spread or pressed into position only the leading and rear edges of said rim will bear against the bottom of said groove.

4. A combination as claimed in Claim 1, wherein tooth-like projections are formed on said rim so that when the ring is spread or pressed into position within the groove said projections alone bear against the bottom of the groove.

5. A needle roller bearing having, in combination, a grooved race and an axial retaining ring substantially as hereinbefore described and shown in Figures 1 or 2 or 4 and 5 of the accompanying drawings.

6. For use in a needle roller bearing having a grooved race, an axial retaining ring substantially as hereinbefore described with reference to Figs. 1 or 2 or 3 or Figs. 4 and 5 of the accompanying drawings.

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801,851 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

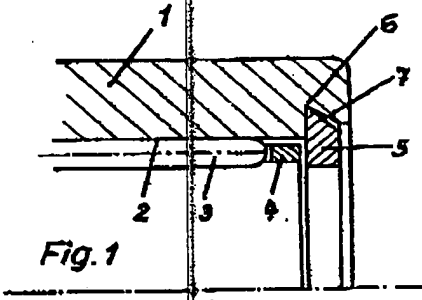

Fig. 1

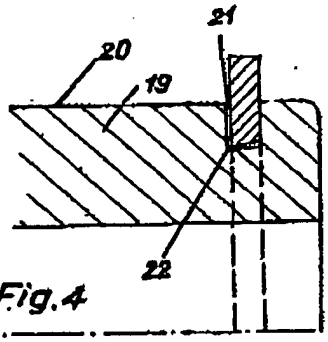

Fig. 4

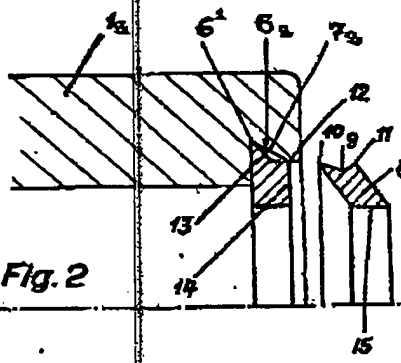

Fig. 2

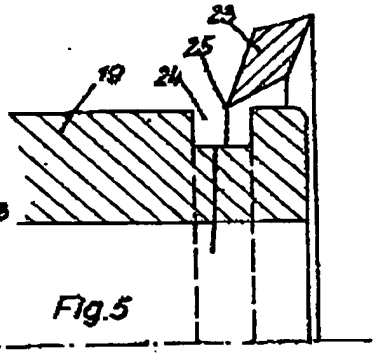

Fig. 5

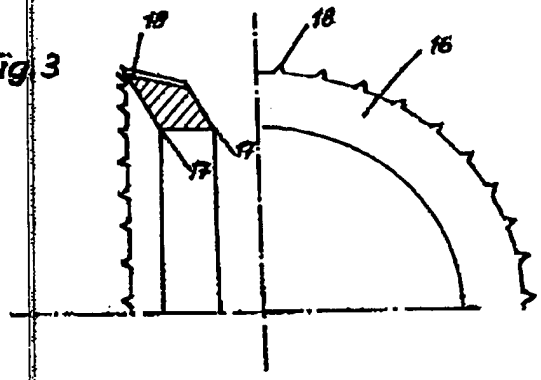

Fig. 3